

Enhancing the Dell iSCSI SAN with Dell PowerVault™ Tape Libraries and Chelsio Unified Storage Router iSCSI Appliance

April 12, 2012

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1.0 Introduction

Over the last five years Dell has established itself as a key player in the iSCSI storage market by emphasizing innovation and building a solid storage solution strategy around the iSCSI storage area network (SAN). Dell's acquisition of EqualLogic and Compellent along with their PowerVault MD 32/36 series of arrays demonstrated to the industry its commitment to iSCSI integration in the Dell storage portfolio.

One of the goals of integrating iSCSI into Dell storage products has not only been to provide the customer with the latest technology for their storage SAN, but to also provide a complete solution where iSCSI is seamlessly integrated into their environment. Delivering this seamless iSCSI solution is an important part of Dell's devotion to providing the customer with every tool available to implement, manage, and maintain their iSCSI SAN.

The introduction of 10Gb iSCSI has driven new product launches for the PowerVault, EqualLogic, and Compellent primary array product lines. Today, the Dell PowerVault TL2000 and TL4000 tape products support 1Gb iSCSI through an integrated bridge card, however, it was essential to provide an end-to-end 10Gb iSCSI solution and further integrate iSCSI into the rest of the PowerVault tape portfolio. This portfolio includes the Dell PowerVault TL2000, TL4000, and ML6000.

2.0 Chelsio Unified Storage Router (USR) SAS-to-iSCSI Appliance

Dell and Chelsio Communications have teamed together to provide a product which could be utilized with the PowerVault tape libraries to provide a 10Gb iSCSI. PowerVault tape libraries already offer a variety of interface options, including Serial Attached SCSI (SAS) and Fiber Channel (FC), but do not have native iSCSI support. The Chelsio-developed USR 1100 SAS-to-iSCSI appliance meets Dell's 10Gb iSCSI tape solution needs.

As shown in Figure 1, the Chelsio USR SAS-to-iSCSI appliance is a 1U rack mounted device which allows the customer to bridge Dell SAS tape devices to their 10Gb iSCSI SAN.



Figure 1 - Chelsio USR SAS-to-iSCSI Appliance

Chelsio USR Port Layout

The Chelsio USR SAS-to-iSCSI appliance features two 10Gb Ethernet ports and two 6Gb SAS ports. This allows the customer to attach up to eight 6Gb SAS tape drives to the iSCSI SAN using a 1 to 4 SAS fan out cable for each SAS port. The Chelsio USR also features two 1Gb Ethernet ports which are used to remotely access the Chelsio USR management interface through a web browser. Alternatively, the management interface can be accessed through the VGA, serial, and USB ports by using a keyboard-video-mouse (KVM) switch. Figure 2 shows the location of key external components of the appliance.

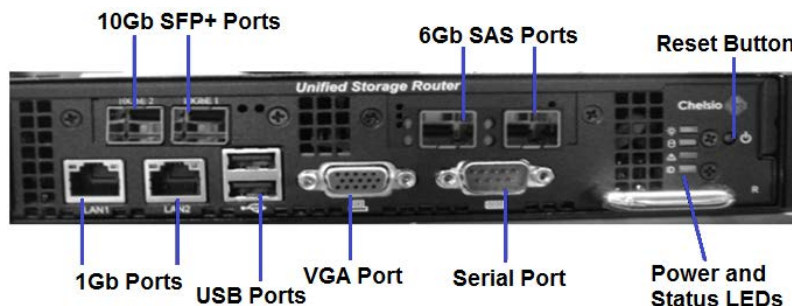


Figure 2 - Chelsio USR Ports

Optimal Connectivity to a Dell PowerVault Tape Library

The Chelsio USR has two 6Gb mini-SAS (SFF-8088) ports which connect to the PowerVault tape library. While a customer could attach only a single mini-SAS to mini-SAS cable to each port this would limit the Chelsio USR to having two tape drive connections.

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The optimal setup to achieve the greatest density of tape drive connectivity is to use external 1x4 mini-SAS to mini-SAS fan out cables to expand the number of tape drives which can be utilized with the Chelsio USR (Figure 3).

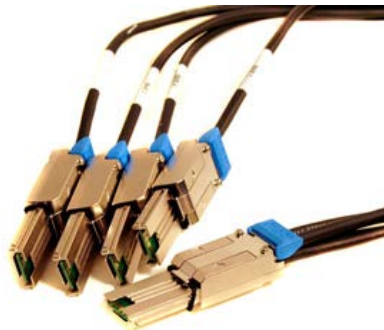


Figure 3 - 1x4 mini-SAS to mini-SAS Fan Out External Cable

Each port on the Chelsio USR is a multi-lane x4 SAS port which when coupled with an external 1x4 mini-SAS to mini-SAS fan out cable, allows up to four SAS tape drive connections per Chelsio USR SAS port. Since there are two SAS ports on the Chelsio USR, this allows up to a total of eight SAS tape drives per Chelsio USR purchased.

Additionally, with an x4 mini-SAS cable the full effective 6Gb bandwidth is replicated on each lane of the cable and is never split between the lanes. For example, if a customer connects a single mini-SAS to mini-SAS cable to one PowerVault LTO5 tape drive they will see performance up to 140 MB/s. Alternatively, when the 1x4 mini-SAS to mini-SAS fan out cable is attached to four PowerVault LTO5 tape drives, all four LTO5 tape drives will still see performance up to 140 MB/s. There is an additional gain in drive capacity on the Chelsio USR, but there should be no significant degradation in tape drive performance by using a 1x4 mini-SAS to mini-SAS fan out cable.

If ordered through Dell, the 1x4 mini-SAS to mini-SAS fan out cables which have been tested and qualified with the Chelsio USR and Dell PowerVault tape products can be purchased in a bundle with the Chelsio USR SAS-to-iSCSI appliance.

Configuring the Tape Library through the Chelsio USR Management Interface

Setting up the tape library on the iSCSI SAN through the Chelsio USR is a very quick and easy task, but requires performing a few steps through the Chelsio USR management interface first. The management interface can be accessed through two methods following the initial setup of the Chelsio USR: 1) connecting an Ethernet cable to one of the 1Gb Ethernet ports, and accessing through a web browser or 2) attaching a KVM switch to the VGA, serial or USB port.

While there are many advanced options available in the management interface, there are only three steps needed to configure the tape library in the Chelsio USR. The home screen of the management interface is shown in Figure 4. The home screen provides a menu infrastructure for navigation on the left of the screen as well as the status of the Chelsio USR and any attached tape libraries on the right.

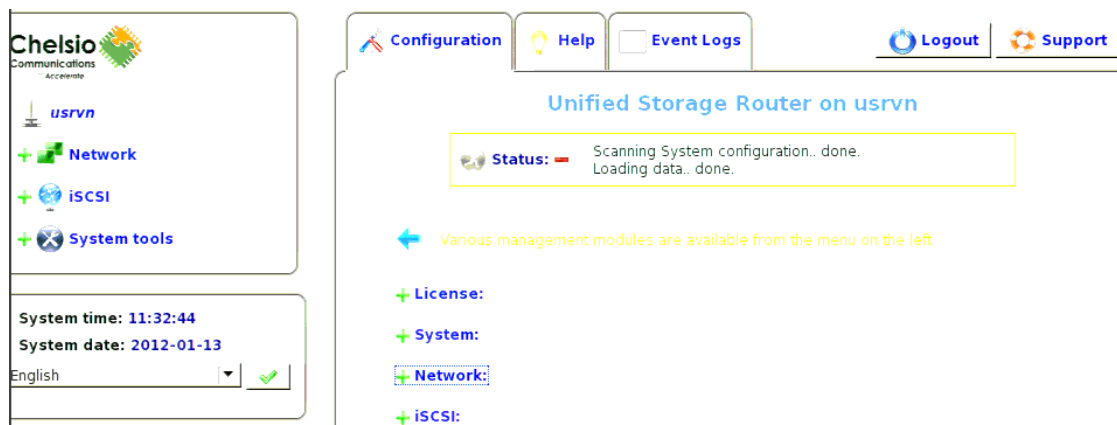


Figure 4 - Management Interface Home Screen

The first step is to ensure the 10Gb Ethernet NICs are properly configured so that the host will be able to see any attached tape libraries connected to the Chelsio USR. By clicking on *Network* in the navigation menu on the left side of the home screen, a list of the four Ethernet NICs in the Chelsio USR – two 10GbE and two 1GbE will be displayed (Figure 5). Input valid network information as it applies to the iSCSI SAN.

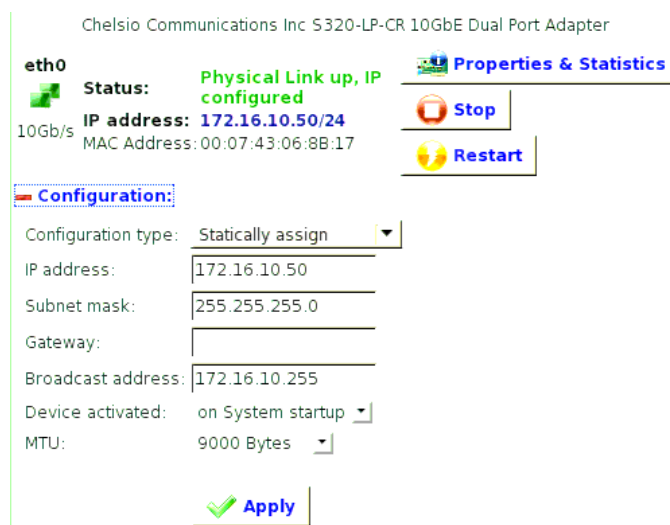


Figure 5 - Network Options for one of the 10GbE NICs

The second step is to add the tape library LUN as an iSCSI target. Selecting *iSCSI* on the navigation menu will display the iSCSI summary of all iSCSI targets currently attached through the Chelsio USR. By further clicking on *Create new target* in the navigation menu, it will open a window allowing you to setup the

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tape library LUN. There are several options which can be specified such as IQN name, alias, IP address and TCP ports. To create the tape library LUN, select the tape library from the *LUN Device* drop down list and then select the IP address of the 10GbE port on the Chelsio USR you want to associate with the tape library (Figure 6). Clicking the *Create iSCSI Target* button should cause the page to refresh and now the tape library should be displayed in the navigation menu under *iSCSI* (Figure 7).



Figure 6 - Creating the Tape Library LUN in the Management Interface

The final step is to add the tape drives in the tape library as LUNs. This step can be repeated for as many tape drives as you want to use in the tape library. The target alias given to the tape library LUN which was added in the previous step should now show up in the *iSCSI* navigation menu. To add a tape drive LUN, click on *LUNs* in the navigation menu, and then select the tape drive you want to add from the drop down list. Click the *Add Lun* button to add the tape drive LUN to the configuration.

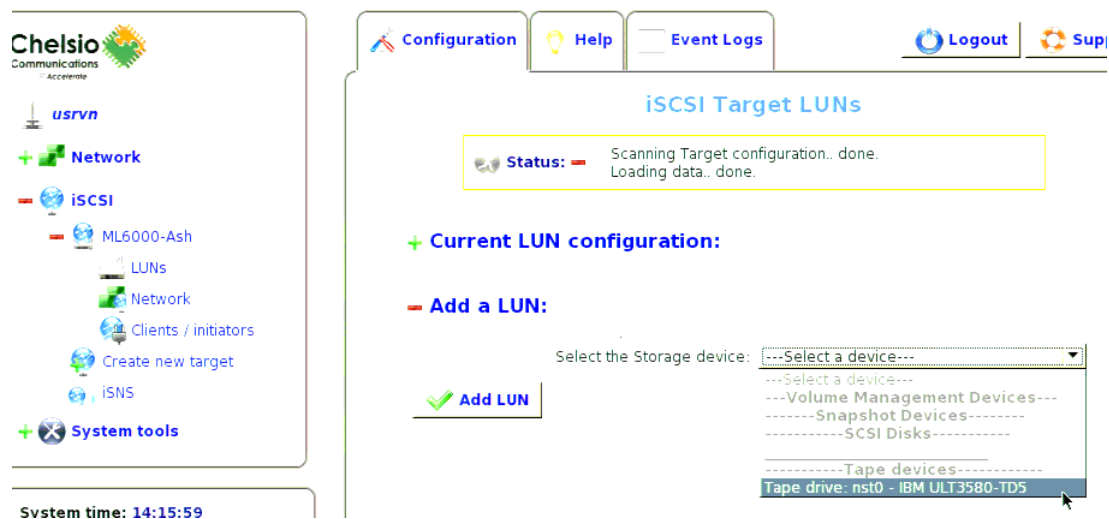


Figure 7 - Adding a Tape Drive LUN to the Tape Library iSCSI Target

Now that the tape library and all attached tape drives are configured in the Chelsio USR, the iSCSI initiator on the iSCSI host, typically where the data protection software is installed, can be setup.

Using a Software iSCSI Initiator with the Chelsio USR

The Chelsio USR supports any standards based iSCSI initiator, however, in most cases customers will be using the software iSCSI initiator included with the operating system on their media server where the data protection software is installed. Due to the sheer number of iSCSI initiators available on the market, configuring iSCSI initiators will not be covered in this whitepaper. However, there are some essential guidelines to follow when setting up any iSCSI initiator with the Chelsio USR to ensure a problem-free detection of the attached tape library.

- Verify the server where the iSCSI initiator is being configured is able to ping the Chelsio USR 10Gb Ethernet port's IP address. Additionally, the Chelsio USR can be used to determine connectivity using the Ping utility found under *System Tools* in the management interface.
- Depending on the type of iSCSI initiator, the tape library may not be automatically discovered. You may need to manually add the IP address or IQN of the port it is connected to on the Chelsio USR. This can be done on the host system through the iSCSI initiator options.
- After discovering the tape library, some iSCSI initiators may only connect to the iSCSI target once and require manual connection following a system reboot. To persistently connect to the iSCSI target through server reboots, look for an option to restore connections when the system is restarted. In many cases it may not be enabled by default.

To find out more about how to configure the iSCSI initiators you may be using in your SAN, consult the documentation or online knowledge bases for the operating system.

3.0 Integrating the Chelsio USR into a Dell Solution

Dell's iSCSI strategy is to ensure customers have an end-to-end iSCSI solution. By implementing the Chelsio USR SAS-to-iSCSI appliance with Dell PowerVault tape, a customer can integrate these devices effortlessly into an existing iSCSI SAN containing other Dell iSCSI storage products, such as the PowerVault MD, EqualLogic PS, and Compellent array.

Dell and Chelsio performed extensive testing to ensure that both the Chelsio USR and Dell PowerVault meet our customer's high expectations. The Chelsio USR was tested with the Dell PowerVault TL2000, PowerVault TL4000, and PowerVault ML6000 in both 1Gb and 10Gb iSCSI environments with other Dell iSCSI storage devices, switches, and various PowerEdge servers.

A reference configuration with an end-to-end iSCSI data protection solution including disk storage being archived to tape is illustrated in Figure 8. The Chelsio USR was connected to both a PowerVault ML6000 and PowerVault TL2000/TL4000 through 6Gb SAS. The Chelsio USR was then connected into the iSCSI SAN through a PowerConnect 8024F switch using SFP+ TwinAx cables. A PowerEdge R810 with a Broadcom NetExtreme 57111 10GbE SFP+ NIC was connected using SFP+ TwinAx cables to a PowerConnect 8024F switch. Finally, the PowerVault MD, EqualLogic PS, and Compellent Storage Center arrays were connected to the 8024F to provide the data storage needs for the testing.

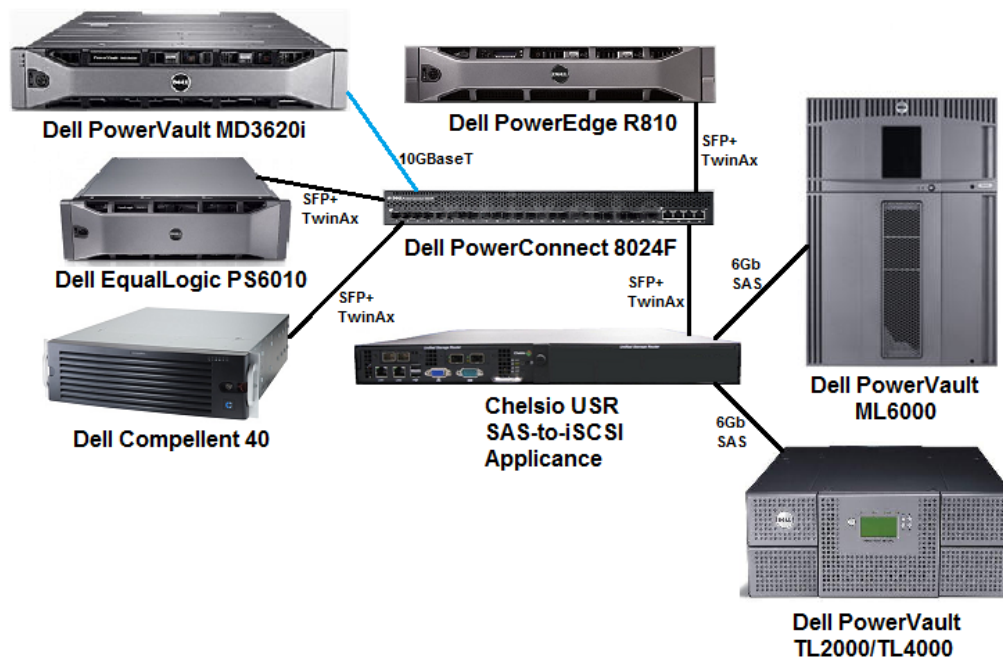


Figure 8 - Chelsio USR Reference Test Architecture

Red Hat Linux and SLES initiators were both tested, however, in this specific configuration, Microsoft Windows 2008 R2 was installed on the R810 and the Microsoft iSCSI software initiator was used.

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Symantec BackupExec 2010 R3 and CommVault Simpana 9 software were also installed on the R810 to perform the backup and restore operations.

Data sets used in the testing consisted of thousands of random data files ranging in size from 1KB to 100MB in size. These data sets were stored on LUNs created on the PowerVault MD, EqualLogic PS, and Compellent arrays and presented to Symantec BackupExec and CommVault Simpana on the R810. The data was used to perform continuous extended backup and restore operations to and from the PowerVault ML6000 and TL tape devices.

Performance was measured on the PowerVault LTO5 tape drives connected to the Chelsio USR using the values reported in the data protection software, as well as various test utilities. Evaluating the effective throughput can be difficult as there are many factors affecting it including: file size, compression, protocol overhead, NIC configuration, and the block size setting on the tape drive. The LTO5 tape drive is capable of streaming data at up to 140 MB/s with 1:1 compressible data. Across various configurations, Dell testing demonstrated performance ranging from 90% to 95% of the max LTO5 throughput. The optimal performance gains were recorded by enabling jumbo frames on the Dell 10GbE NICs and configuring the tape drive to run at 256KB block size. These settings may not work for all environments and may need adjusting depending on your data set and hardware to obtain the optimal throughput.

Throughout the testing, all Dell storage devices, switches, and servers connected in the iSCSI SAN were closely monitored to evaluate the impact on the entire iSCSI solution infrastructure. The Chelsio USR was tested to the same rigorous test procedures run on Dell's own storage products and all configurations tested passed all functional, reliability, and performance test scenarios.

4.0 Conclusion

Dell's introduction of the Chelsio USR SAS-to-iSCSI appliance allows Dell customers the opportunity to seamlessly integrate PowerVault tape products into their existing and future Dell iSCSI storage solutions. The Chelsio USR has been tested to ensure compatibility with some of the latest Dell EqualLogic, Compellent, PowerConnect, PowerEdge, and PowerVault MD hardware. When paired with PowerVault tape libraries, the Chelsio USR provides an easy to setup, remote manageable, and high performing data protection option to customers who are looking for an avenue to transition to iSCSI.

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